

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

OPEN CHANNEL

(Feet)

CODE 582

DEFINITION

Constructing, improving, recreating, or restoring a channel in which water flows with a free surface. A channel can have a fixed boundary or a movable boundary. Changes in bed elevation or bank location are not expected to occur in fixed boundary channels. Movable boundary channel bed and banks consist of materials transported by the channel and changes in the bank location and bed elevation are expected to occur.

PURPOSE

This standard may be applied as part of a resource management system to support one or more of the following:

1. Re-establish or improve a channel to accommodate low flows, provide for riparian vegetation establishment and growth on the floodplain, reduce bank erosion, improve flood plain function and stability and modify sediment transport.
2. Provide improved water quality and habitat for aquatic species and improved riparian habitat for upland species.
3. Provide needed discharge capacity required for design flow transport.
4. Maintain water surface elevation in floodplains, riparian areas, and wetlands.
5. Provide drainage of excess surface water.
6. Prevent the loss of land, damage to utilities, roads, buildings, or other facilities adjacent to the banks.

7. Restore the visual quality of the stream corridor.
8. Provide other authorized water management purposes.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to construction of new channels or modifications of existing channels.

It applies where stability requirements can be met, where the impact of the proposed construction on water quality, fish and wildlife habitat, forest resources and quality of the landscape is evaluated, and the techniques and measures necessary to overcome the undesirable effects are made part of any planned work. It is also necessary to provide an outlet for discharge by gravity flow or pumping, and where excavation or other channel work does not cause significant erosion, flooding or sedimentation.

This standard applies to Floodwater Diversion (400), Floodway (404), or Surface Drainage, Main or Lateral (608), having a drainage area in excess of one square mile.

This standard does not apply to Diversion (362), Grassed Waterway (412), Irrigation Field Ditch (388), Surface Drainage, Field Ditch (607), or Irrigation Canals or Laterals (320).

This standard does not apply to short reaches of streams that should be treated by using Practice Standard (580)-Streambank and Shoreline Protection or (584)-Stream Channel Stabilization.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

**NRCS, IA
February 1986**

Reviewed January 2002

ENVIRONMENTAL CONSIDERATIONS

Due consideration shall be given to the maintenance of wildlife habitat. The landuser will be advised if wetlands will be affected and that current NRCS wetland policy will apply. (See part 506, NCPM.)

CRITERIA

Plan. Channel construction or modification shall be according to an approved plan prepared for the site. TR-25 shall be used in surveys, planning, and site investigations for channel work. Design criteria in TR-25 shall be followed, using the procedure best adapted to site conditions.

In selecting the location and design of channels, careful consideration shall be given to minimizing water pollution, damage to fish and wildlife habitat, and to protecting forest resources and the quality of the landscape. In considering requirements for construction and operation and maintenance, selected woody plants must be preserved. The overall landscape character, prominent views, and fish and wildlife habitat requirements must be considered.

Planned measures necessary to mitigate unavoidable losses to fish or wildlife habitat shall be included in the project. The quality of the landscape shall be maintained by both the location of channel works and plantings, as appropriate.

The alinement of channels undergoing modification shall not be changed to the extent that the stability of the channel or laterals thereto is endangered.

Capacity. The capacity for open channels shall be determined according to procedures applicable to the purposes to be served and according to related engineering standards and guidelines in handbooks. The water surface profile or hydraulic gradeline for design flow shall be determined according to guidelines for hydraulic design in TR-25. The "n" value for aged channels shall be based on the expected vegetation, along with other retardance factors, considering the level of

maintenance prescribed in the operation and maintenance plan prepared with the owners or sponsors. The required capacity may be established by considering volume-duration removal rates, peak flow, or a combination of the two, as determined by the topography, purpose of the channel, desired level of protection, and economic feasibility.

Cross Section. The required channel cross section and grade shall be determined by the plan objectives, the design capacity, the materials in which the channel is to be constructed, the vegetative establishment program, and the requirements for operation and maintenance. A minimum depth may be required to provide adequate outlets for subsurface drains, tributary ditches, or streams. Urban and other high-value developments through which the channel is to be constructed must be considered in the design of the channel section.

Channel Stability. Characteristics of a stable channel are:

1. The channel neither aggrades nor degrades beyond tolerable limits.
2. The channel banks do not erode to the extent that the channel cross section is changed appreciably.
3. Excessive sediment bars do not develop.
4. Gullies do not form or enlarge because of the entry of uncontrolled surface flow to the channel.

All channel construction and modification (including clearing and snagging) shall be according to a design that can be expected to result in a stable channel that can be maintained at reasonable cost. Vegetation, riprap, revetments, linings, structures, or other measures shall be used if necessary to insure stability.

The method applicable to site conditions in TR-25 shall be used in determining the stability of proposed channel improvements.

Bankfull flow is the flow in a channel that creates a water surface at or near the normal ground elevation, or the tops of dikes or

continuous spoil banks that confine the flow for a significant length of a channel reach.

Channels must be stable under conditions existing immediately after construction (as-built condition) and under conditions existing during effective design life (aged condition). Channel stability shall be determined for discharges under these conditions as follows:

1. As-built condition – Bankfull flow, design discharge, or 10-year-frequency flow, whichever is smallest, but not more than 150 percent nor less than 50 percent of design discharge.

The allowable as-built velocity (regardless of type of stability analysis) in the newly constructed channel may be increased by a maximum of 20 percent if:

- a.) The soil and site in which the channel is to be constructed are suitable for rapid establishment and support of erosion-controlling vegetation,
 - b.) Species of erosion-controlling vegetation adapted to the area and proven methods of establishment are known, and
 - c.) The channel design includes detailed plans for establishing vegetation on the channel side slopes.
2. Aged condition – Bankfull flow or design discharge, whichever is larger, except that it is not necessary to check stability for discharge greater than the 100-year frequency.

Stability checks that are flow related are not required if the velocity is 2 ft/s (0.6 m/s) or less.

For newly constructed channels in fine-grained soils and sand, the “n” values shall be determined according to procedures in Chapter 6 of TR-25, and shall not exceed 0.025. The “n” value for channels to be modified by clearing and snagging only shall be determined by reaches according to the expected channel condition upon completion of the work.

Appurtenant Structures. The channel design shall include all structures required for

proper functioning of the channel and its laterals, as well as travelways for operation and maintenance. Inlets and structures needed for entry of surface and subsurface flow into channels without significant erosion or degradation shall be included in the channel design. The design also shall provide for necessary flood gates, water-level-control devices, bays used in connection with pumping plants, and any other appurtenances essential to the functioning of channels and contributing to attainment of the purposes for which they are built. If needed, protective structures or treatment shall be used at junctions between channels to ensure stability at these critical locations.

The effect of channel work on existing culverts, bridges, buried cables, pipelines, irrigation flumes, and inlet structures for surface and subsurface drainage on the channel and laterals thereto shall be evaluated to determine the need for modification or replacement.

Culverts and bridges that are modified or added as part of channel projects shall meet reasonable standards for the type of structure and shall have a minimum capacity equal to the design discharge or state agency design requirements, whichever is greater. Capacity of some culverts and bridges may need to be increased above the design discharge.

Disposition of Spoil. Spoil material from clearing, grubbing, and channel excavation shall be disposed of in a manner that will:

1. Not confine or direct flows so as to cause instability when the discharge is greater than the bankfull flow.
2. Provide for the free flow of water between the channel and flood plain unless the valley routing and water surface profile are based on continuous dikes being installed.
3. Not hinder the development of travelways for maintenance.
4. Leave the right-of-way in the best condition feasible, consistent with the project purposes and adjacent land uses.

5. Direct water accumulating on or behind spoil areas to protected outlets.
6. Maintain or improve the visual quality of the site to the extent feasible.

Vegetation of Channel. Vegetation shall be established on all channel slopes, berms, spoil, and other disturbed areas according to the NRCS Standard for Channel Vegetation (322).

Channel side slopes are to be seeded as soon as possible after excavation. Use daily seeding whenever possible. Annual species may be used for daily seeding if necessary to ensure a quick ground cover.

SPECIAL CONSIDERATION FOR URBAN AREAS

Level of Protection. Channels or channel systems shall be designed so that:

1. The water surface elevation attained during the passing of the runoff from a 100-year frequency, 24-hour duration storm shall be such that all floors of living units or commercially used buildings will be free from water.
2. The water surface elevation attained during the passing of the runoff from a 50-year frequency, 24-hour duration storm shall be such that no water enters openings of basements that contain no dwelling units. Runoff from a storm of this frequency and duration shall not affect any habitable building adversely.
3. Streets shall remain useable during runoff from a storm equivalent to a 10-year return frequency of a 24-hour duration.

Minimum Criteria.

1. For shallow drainageways or surface drainage ditches in urban areas for drainage up to 20 acres use:

Design Peak Capacity – 1 c.f.s. per acre of drainage area

Minimum grade – 0.3 percent

Minimum top width – 8 feet

Minimum depth – 0.5 feet

2. For channels with drainage areas over 20 acres, use peak discharges consistent with the level of protection required, but in no case shall the bankfull elevation contain less than the 10-year frequency discharge.

Peak rates of runoff for drainage areas up to 2,000 acres shall be determined as outlined in TR-55, Urban Hydrology, or by other acceptable methods.

OPERATION AND MAINTENANCE

Plan. An operation and maintenance plan must be prepared for each channel system. Minimum requirements for operation, maintenance, and replacement shall be consistent with the design objectives. This includes consideration of fish and wildlife habitat, quality of the landscape, water quality, mitigation features, methods, equipment, costs, stability, function for design life, frequency, and time of year for accomplishing the work. Detailed provisions for operation and maintenance must be made if complex features, such as water level-control structures and pumping plants, are required.

Maintenance Access. Travelways for maintenance generally shall be provided as part of all channel work. This requirement may be met by providing ready access points to sections of the channel if this will permit adequate maintenance in conformance with the operation and maintenance plan.

A travelway shall be provided on each side of large channels if necessary for use of maintenance equipment. Travelways must be adequate for movement and operation of equipment required for maintenance of the channel. The travelway may be located adjacent to the channel on a berm or on the spread spoil. In some places the channel itself may be used as the travelway. The travelway, including access points, must blend into the topography, the landscape, and adjacent land uses.

Safety. Open channels can create a safety hazard. Appropriate safety features and devices should be installed to protect people and animals from accidents such as falling or drowning.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing open channels shall be in keeping with this standard and shall describe the requirements for properly installing the practice to achieve its intended purpose.